Diploma Programme
Programme du diplôme
Programa del Diploma

Mathematics: analysis and approaches
Standard level
Paper 1

14 May 2026

Zone A afternoon | **Zone B** afternoon | **Zone C** afternoon

Session number

1 hour 30 minutes

Instructions to students

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- You are not permitted access to any calculator for this paper.
- Section A: answer all questions. Answers must be written within the answer boxes provided.
- Section B: answer all questions in the answer booklet provided. Fill in your session number on the front of the answer booklet, and attach it to this examination paper and your cover sheet using the tag provided.
- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.
- A clean copy of the **mathematics: analysis and approaches SL formula booklet** is required for this paper.
- The maximum mark for this examination paper is **[80 marks]**.

2226–5028

Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

Section A

Answer **all** questions. Answers must be written within the answer boxes provided. Working may be continued below the lines, if necessary.

1. [Maximum mark: 6]

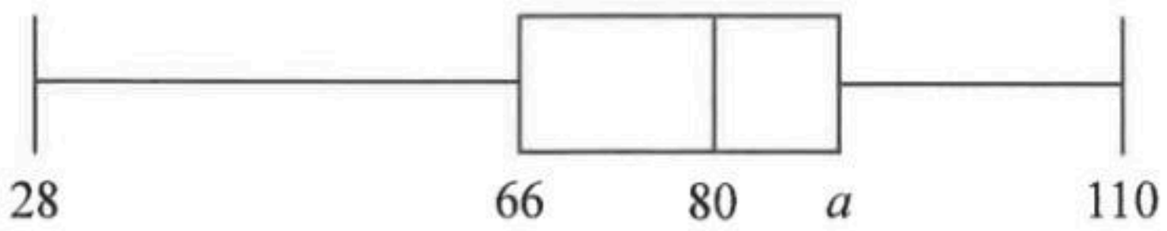
A school has 600 students across four grade levels as shown in the following table.

Grade	Number of students
9	115
10	178
11	137
12	170

A group of 60 students was surveyed using a stratified sampling technique, such that each grade in the sample was proportional to the population. Each student was asked how much allowance, in Singapore dollars ($), they received per week.

(a) Find the number of Grade 12 students in the sample. [2]

The results of the survey are summarized in the following box and whisker diagram.



Survey of allowances from 60 students

(b) State the median. [1]

The interquartile range is $\$24$.

(c) Write down the value of a. [1]

An outlier is a value that is less than $Q_1 - 1.5 \times \text{IQR}$ or greater than $Q_3 + 1.5 \times \text{IQR}$.

(d) Determine the smallest possible allowance, from the sample, that is not an outlier. [2]

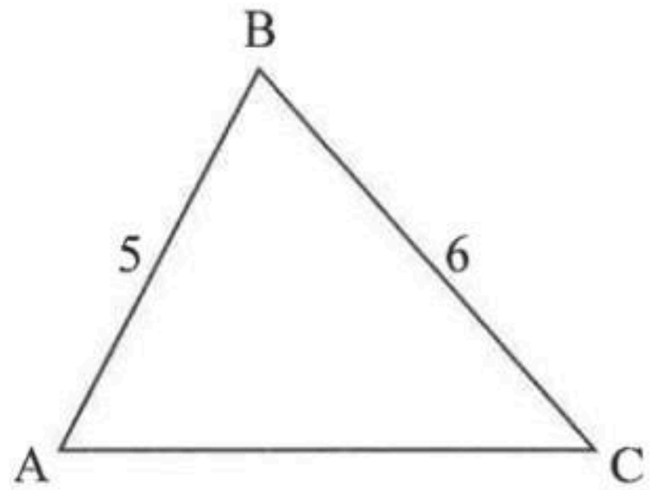
(This question continues on the following page)

(Question 1 continued)

2. [Maximum mark: 7]

The following diagram shows triangle ABC. It is known that $AB = 5\,\text{cm}$, $BC = 6\,\text{cm}$, and $\cos A\hat{B}C = \frac{1}{5}$ where $A\hat{B}C$ is acute.

diagram not to scale



(a) Find AC. [3]

(b) (i) Show that $\sin A\hat{B}C = \frac{2\sqrt{6}}{5}$.

(ii) Hence, find the area of triangle ABC. [4]

3. [Maximum mark: 6]

Consider the expansion of $(1+mx)^8$, where $m \in \mathbb{R}$ and $m > 0$.

The coefficient of x^3 is eight times the coefficient of x^2.

(a) Show that ${}^8C_3 = 56$. [1]

(b) Find the value of m. [5]

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4. [Maximum mark: 6]

In this question, p and r are positive integers greater than 1.

(a) Given that $\log_3 p = 3 + \log_3 r$, show that $p = 27r$. [2]

(b) Hence, find the value of r and the value of p that satisfy these simultaneous equations:

$$\log_3 p = 3 + \log_3 r$$

$$\log_r p = 4$$ [4]

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5. [Maximum mark: 5]

Let $y = x^4 - \sin 4x$.

(a) Find $\frac{dy}{dx}$. [2]

(b) Hence, or otherwise, find $\int (x^4 - \sin 4x)^7 (x^3 - \cos 4x)\,dx$. [3]

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6. [Maximum mark: 6]

The function f is defined by $f(x)=4-\frac{7}{3x+2}$, where $x \in \mathbb{R}$, $x \neq -\frac{2}{3}$.

(a) Find an expression for $f^{-1}(x)$. [3]

The function g is defined such that $(f \circ g)\left(\frac{x}{3}\right)=x$.

(b) Using your answer to part (a) or otherwise, find an expression for $g(x)$. [3]

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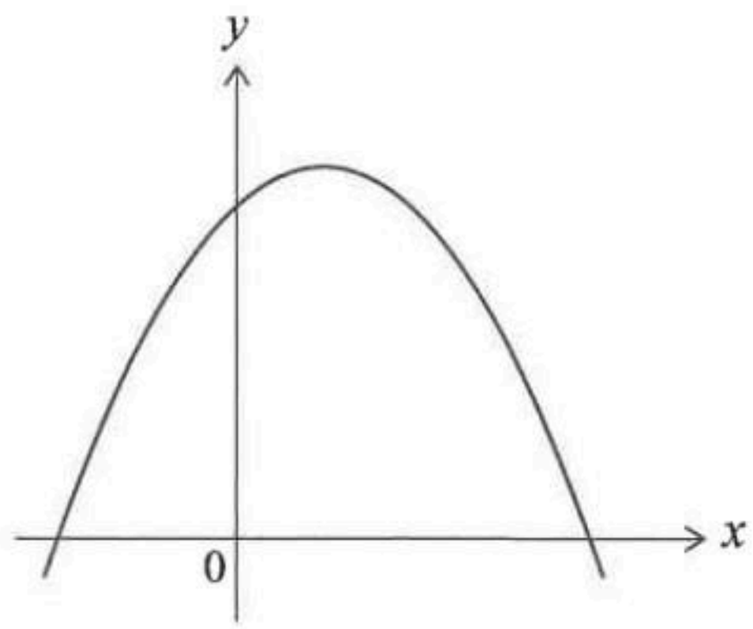
Do **not** write solutions on this page.

Section B

Answer **all** questions in the answer booklet provided. Please start each question on a new page.

7. [Maximum mark: 14]

Consider the quadratic function $f(x) = -(x+2)(x-4)$, for $x \in \mathbb{R}$. The following diagram shows part of the graph of f.



(a) (i) Find the x-coordinate of each of the x-intercepts.

(ii) Find the coordinates of the vertex. [5]

The function f can also be written in the form $f(x) = -(x-h)^2 + k$, where $h, k \in \mathbb{R}$.

(b) Write down the value of

(i) h;

(ii) k. [2]

The line $y = mx + 4$, where $m \in \mathbb{R}$, intersects the graph of f at $x = -2$ and $x = 2$.

(c) Determine the value of m. [3]

Consider the equation $-x^2 + 2x + 8 - p = 0$, where $p \in \mathbb{R}$.

(d) By considering the graph of f, or otherwise, find the range of possible values of p such that this equation has

(i) two distinct real roots;

(ii) two distinct positive real roots. [4]

Do **not** write solutions on this page.

8. [Maximum mark: 16]

The functions f and g are defined for $0 \leq x \leq \pi$ by

$$f(x) = \sin 2x$$
$$g(x) = 1 - \cos 2x.$$

(a) Solve the equation $f(x) = g(x)$ for $0 \leq x \leq \pi$. [6]

(b) Sketch the graphs of $y = f(x)$ and $y = g(x)$ on the same set of axes, clearly labelling the points of intersection with their coordinates. [4]

The graphs of f and g intersect at $x = a$ and $x = b$, where $0 < a < b$.

(c) Find the area of the region enclosed by the graphs of f and g for $a \leq x \leq b$. [6]

Do **not** write solutions on this page.

9. [Maximum mark: 14]

Consider the function $h(x) = \frac{e^{2x} + x}{x}$, for $x > 0$.

(a) Show that $h'(x) = \frac{e^{2x}(2x-1)}{x^2}$. [4]

(b) Find the values of x for which h is an increasing function. [2]

(c) Find the equation of the normal to the curve $y = h(x)$ at the point $(1, e^2 + 1)$. [4]

The second derivative of h is given by $h''(x) = \frac{2e^{2x}\left(2x^2 - 2x + 1\right)}{x^3}$.

(d) Show that the graph of h does **not** have a point of inflexion. [4]